WIRE & WIRE PRODUCTS

In This Issue:

Chain Manufacture in Europe
By M. A. Irmischer

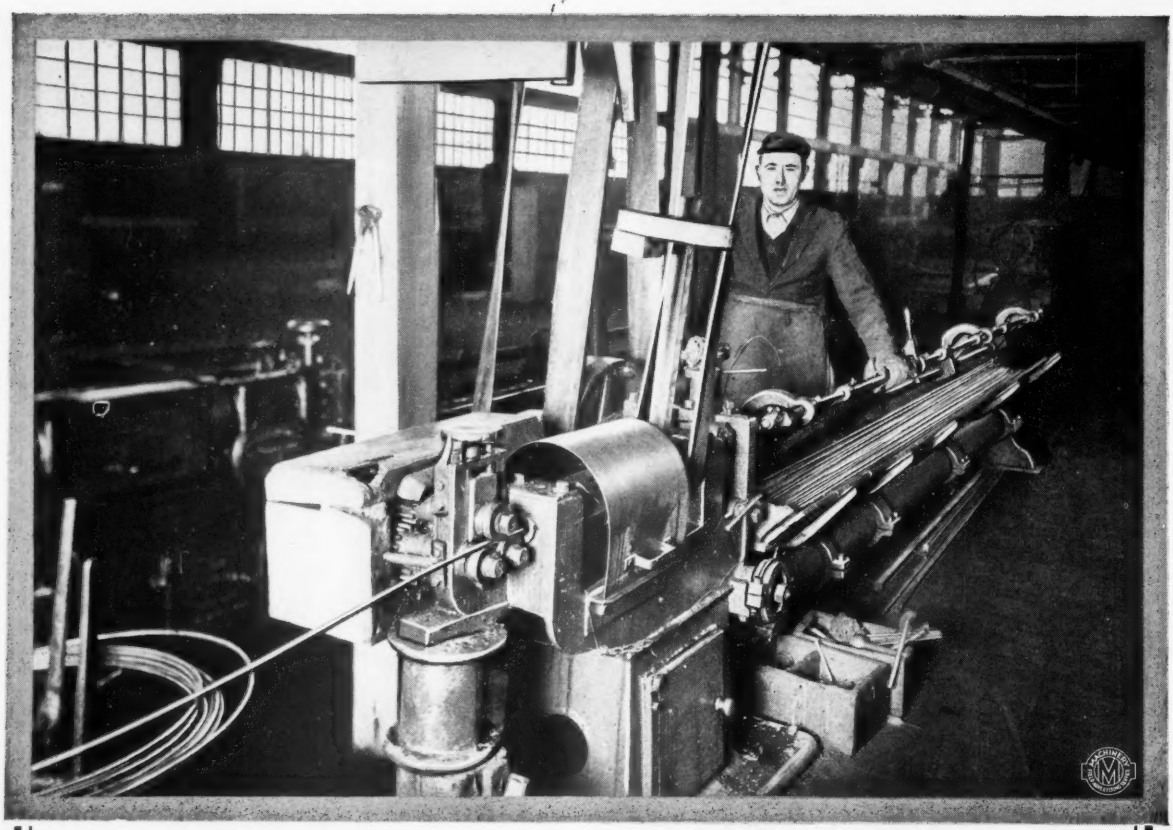
Lead Baths and Annealing Furnaces
By H. Altpeter

Insulation and Enamelling in the Ford Wire Plant
By Carl Marx

Review of Recent Patents

News

October 1926



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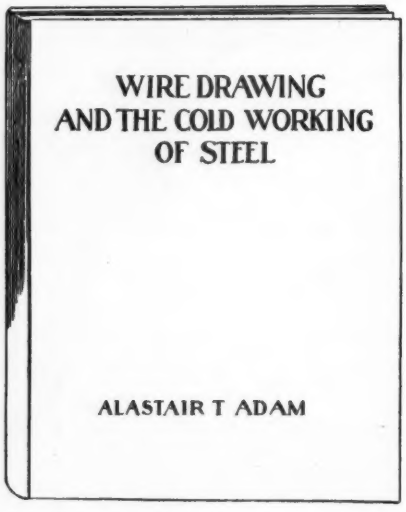

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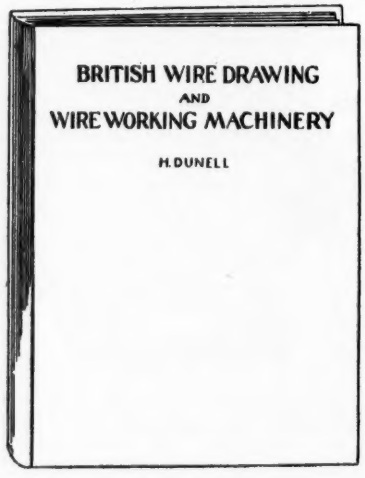

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WIRE AND WIRE PRODUCTS

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IN our preceding issue we, quite unintentionally and — we hope — excusably, omitted mention of the sincere appreciation we feel towards our active contributors. For this sin of omission, we wish heartily to atone here.

The numerous contributions which we are receiving monthly indicates not merely a vital, stimulating interest in the discussion of various problems of the wire industry, but establishes the fact—to which we point with pride—that WIRE & WIRE PRODUCTS has been recognized as *the* medium through which the industry is to be reached. It has become, so to speak, the industry's official organ without losing any of its initial independent status.

We are pleased to note also that our efforts to extend the scope of WIRE & WIRE PRODUCTS, to cover not merely wire drawing processes, but also the manufacture of wire products, has been thus far successful and promises even more far reaching results for the future.

The contributions from technicians of well known manufacturers of wire products are especially interesting, and in response to the few already published we received a number of conmendatory letters both from American and European firms.

Technical contributions, indeed, have not been wanting, and have been submitted by experts well known to the wire industry. We wish we could say as much for articles on merchandising. This department, while not inactive, has not received the attention we would like to give it. You sales executives—what about some sales stories?

The Publishers.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 1 October, 1926 No. 6

Contents

Development of Chain Making in Europe, By M. A. Irmischer 187

The New Ford Wire Plant, Part II, By Carl Marx - - - 190

Wire in the Delaware River Bridge, By Charles Carswell - - 192

The Manufacture of Steel and Iron Wire in Germany By H. Altpeter - - - 194

Types of furnaces and lead baths for the heat-treatment of wire.

Doing Without the Jobber, By R. Schlossberg - - - - - 196

Overhead Monorail Systems in Wire Plants - - - - - - 197

Editorials - - - - - - - - - - - - - - - - - 200

Views of the Wire World - - - - - - - - - - - - - 201

Lubrication of Wire Rope - - - - - - - - - - - - 202

Detecting Broken Strands in Cables - - - - - - - - - 203

Digest of Literature - - - - - - - - - - - - - - 204

Review of Recent Patents, By Eugene Grunstein - - - - 205

News of the Industry - - - - - - - - - - - - - - 206

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WIRE
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Vol. I OCTOBER, 1926 No. 6

The Development of Chain Making in Europe

By M. A. Irmischer

WHEN we review the history of chain manufacture, we will be surprised to gather from it that the ancients from 1000 B. C, on were acquainted with the art of metal working and that they forged iron chains. The "putting in chains" of the prisoners of that time is the best evidence of the use of these chains. But not until the last 100 years have the chains come into commercial practice. The first cable made of iron chains, of which we have definite knowledge was made by Robert Flinn, North Shields, near 1808, and was brought on board the ship Ann and Isabella which was built at Berwicken Tweed. This chain cable of Flinn was the original oval link model. About 1812, Lieut. Brown, introduced the transverse bar in the chain link which is today known in connection with all ship-chain cables and which makes for about 20 per cent. higher strength.

The home chain makers of England, particularly those in the Northeast of England and in Staffordshire, where the whole family was busy at the production, played a particularly important role in those years. Those two centers were rivals from time to time, for each one had his own method of manufacturing. In the Northeast of

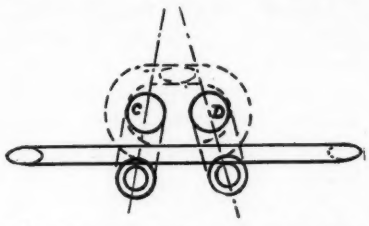


Fig. 1. Diagrammatic view of the link-bending mechanism.

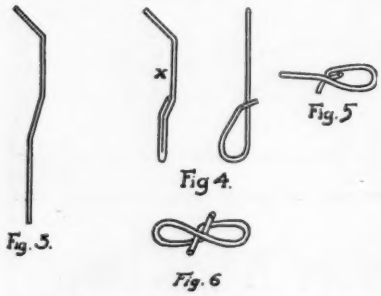
England they welded the links at the sides, whereas in Staffordshire they welded them at the end. Through the lateral joint a better welding of greater strength was achieved. This was due to the longer scarf possible since this offered a larger surface for the joint. As long as cheapness regulated the market, the demand for chains welded at the end was very great. The competition began, to find more economical methods of producing the strongest chains with the best welding.

For under all circumstances it was attempted to bring the strength of a chain—which was about 80 per cent. of the strength of both link-shanks, with perfect welding—to its maximum value. It was clear that with poorer weld, the chain would be much worse, and that the strength would then decrease to about 10 per cent. However, the competition previously mentioned showed that hand in hand with the quality of these chains, a more economical manufacture must take place. The effort was centered in the first place in the easier and more economical forming of chain links.

And so it has been tried in the course of the 19th century to build machines which formed the links separately. At first only links made of material over two inches in diameter were formed by machines. This was done on hydraulic bending machines. At the same time one had the links overlapped, heated to welding heat and welded under a hammer. The output of chain makers was at that time one link per minute—$\frac{7}{16}$-inch wire diameter—and about one link in four minutes when wire of $\frac{7}{8}$-inch diameter was used. Later on this output could be quadruplicated by the following method:

On a link winding machine the wire was coiled around a

mandrel, having a helical groove. For this process the pitch of the helical grove was made twice the wire diameter, to make the linking together of the finished links possible, and to facilitate the cutting of



Figs. 3-6. Steps in the formation of a knotted-chain link.

the scarf which was done on a special machine.

After the links were coiled this way and sheared off, they were heated to welding heat, linked together, the skew joint surfaces were united by hammer-blow and finally welded between the dies of a power or of a spring hammer. In Continental plants at that time the links were formed by the following method:

The straight bars were sheared at an angle for the scarfing in the exact lengths required for the links. These bars were heated and placed in a mechanism as shown in Fig. 1 and passed through the link which was finished before. By special formers, turning with their rolls around centers c and d about half of a revolution, these straight, hot bars were formed into links, and welded overlapping, as described before. The chain links were formed similarly in England. The only difference was that the forming mechanism was adapted to the elliptic type of link in use in England.

To increase production a new combination machine was constructed in 1908 which formed the links and welded them at the same time. The bar, which was of square cross-section, cut to exact lengths was passed through the previously finished link, rolled into a ring form and then, by means of the hammering mechanism in the machine, was welded, and its cross section forged to a round form, and finally pressed into an oval formed link. From 100 to 120 links were made per hour by this machine from $\frac{5}{8}$-inch material. Fig. 2 shows the individual operations in the forming of a link. A is the bent link, B is the link welded and forged, and C is the link in oval form and finished.

The reliability of such welded chains depended, of course, upon the ability of the worker and occasional accidents due to poor welding, induced many chain manufacturers to look for methods eliminating these falts.

And so in the recent decades chains have been invented not even needing any welding. Best known among these are the Flat-Link Chains, the Bulldog, Brown or Knotted Chains and the so-called Weldless Steel Chains.

The Flat-Link Chains were made on an automatic machine from a strip of sheet metal. On an automatic machine of early design, these flat-link chains would have been made as follows:

The material for one link was punched from a strip. This punched piece, having two shaped holes or eyes near each end, was put through the eye of the link previously bent. Then the punched piece was bent by two jaws so that the two eyes were superposed. Through the

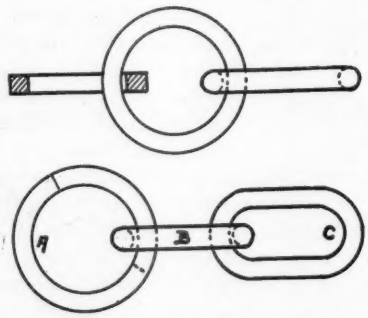


Fig. 2. Three operations in forming the link: A, bending; B, welding; C, forming.

eye formed this way the bar for the next link was put through, so that finally a continuous chain was formed and was given a flat form by a pressing operation in the machine.

The prevalent type of Knotted chain is the so-called Bulldog and Brown chains which are nowadays manufactured in a most economical way. Malmedie & Co., Maschinenfabrink A. G. Dusseldorf in Germany are manufacturers of a machine operating entirely automatically. The machine feeds the wire up to a stop, cuts it and bends it by bending tools as shown in Fig. 3. A Roller forms the first eye (see Fig. 4). At x a hook-formed tool takes hold and draws the wire between the jaws of a die forming the second eye between as shown in Fig. 5. By a special conveying mechanims, the link

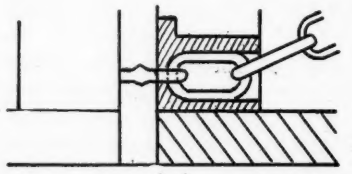


Fig. 7. The welding process. A link held in position for electrical welding.

is brought into the position shown in Fig. 6 and into a knotting device where both ends are knotted. Up to 90 links per minute can be made by this process.

The weldless Steel Chains were another kind of chains, already manufactured in previous years. They were made from steel bars of cross shaped cross-section out of which the chain form was pressed. The links were then separated and finished. These weldless steel chains have great strength, but their use is limited for special purposes mainly because the manufacturing process is more expensive.

Therefore, as the problem was not definitely solved, it seemed advisable again to improve the manufacturing of welded chains. About 40 years ago, the electrical resistance welding process became applicable for practical use and it im-

mediately was taken into consideration. In 1898 the Electric Chain Welding Machine was constructed by E. Thomson. In this machine, link by link is butt-welded. The link is fixed between two pairs of copper jaws (Fig. 7), and the current is led through the upper jaws. The right hand table was movable and pressed upon the link while the current was passing. However, this process left a swelling on both link-shanks. After each welding process a special mechanism turned the chain 90 degrees and moved it ahead the length of one link. The main difficulties in this process were to obtain chains with reliable and quick welding and uniform cross-section. However, it can be easily proved that electrical resistance welding is much more economical than other methods.

For instance, to bring wire of 49/64 sq. inch to welding heat of 1200 degrees Celsius needs 20 kw. current for 15 seconds, which is about 0.08 kw. hours. One minute at the most is required for starting the process and taking away the wire, inserting and removing the link. In ten hours, therefore, approximately 600 weldings could be made consuming a total of 48 kw. hours.

The same 600 welds performed by two men in fire welding process requires:

Five minutes per welding or 600 times 5 equals 3000 minutes or 50 hours.

As per each day about 200 pounds of coal are necessary for 55 days about 1,000 pounds of coal are needed.

The costs therefore would be:

Electrical process: 48 kw. hours and salary for 1 man for 1 day.

Fire process: 1,000 pounds of coal and salary for 2 men for 5 days each.

In any case it was advisable to take advantage of the greater economy of the electrical welding process. The prerequisite, of course, for the good electrical welding is that the product be bent absolutely precisely. The links must be perfectly symmetrical, even, and without any damage, and the transverse end surface must fit tightly and close. As an example of a modern forming machine, we might consider that type which is shown schematically in Fig. 8.

The wire is fed through a hole (a) up to a stop (b) for each process in exactly equal lengths. It is cut in the moment when both bending tools (c and d) press the wire against a mandrel. Combined with the bending tool (f) these bending steels c and d bend the wire into U form. Two bending steels, i and k, which are operating from the sides together with guides g and h, close the U form to the finished link which is hanging on a catch rod. During the process both guides are moved along the curves of steel bed (1) in a way that the bending tools operating from the sides have to make a movement at the same time along the longitudinal axle of the link, by which is obtained an exact closing of the link and the accurate meeting of the ends which are to be connected. The mandrel disappears and an additional light pressure of the pressing tools gives afterwards the neat, evenly closed form of the link.

This is obtained mainly because all tensions due to the bending process are eliminated. A so-called holder then catches the link on the jointless shank, the tools recede and the catch rod takes the link off after the holder has been lifted.

The same catch rod brings the link in a hollow of the mandrel, so that the next link is closed through it. This taking off process must be performed alternately at the left and at the right top-ends of the links to make sure that the welded part of the chain sides is not displaced more than 90 degrees forwards and backward. This makes the working of the welding machine simpler.

The machines produce, automatically, continuous chains and according to the newest improvements they may even be equipped with a mechanism by which the production of separate pieces of chains of certain lengths is possible without any loss of time for special adjustment of the machine.

(*Continued on page 207*)

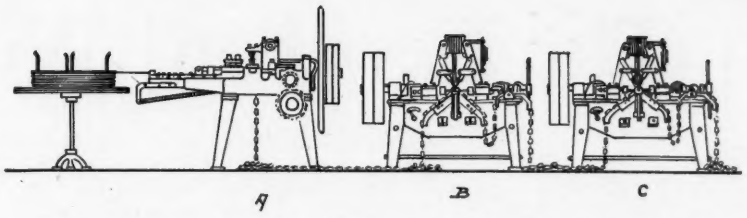


Fig. 9. Showing arrangement of machines described in this article. A, automatic chain former; B, automatic electric chain welder.

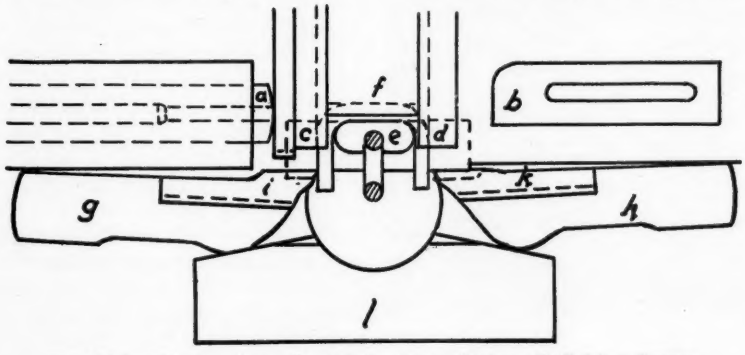


Fig. 8. Schematic view of a modern link forming mechanism embodied in a German chain making machine.

The New Ford Wire Plant

PART II

Unique installation and shop methods in the Wire Department of the Ford Plant

By Carl Marx

The Insulation

A LARGE part of the plant is devoted to the insulation of the various types of wire manufactured. There are 27 No. 1½ machines for cotton covering. The cotton is first wound on special machines into ¾-pound packages in a ribbon form of 20 strands of cotton. The insulating machines then wrap this cotton about the wire as it passes through in a vertical direction. A set of similar machines perform the silk covering of the finer sizes of wire.

The cable, to cite but a few examples, is first covered with paper. This is accomplished on some of the machines at the same time that the cable is made, thus obviating a separate operation. After the paper follows a coating of rubber which is vulcanized. Friction tape is applied over the vulcanized rubber coating and then the cable is covered with cotton braid.

The cotton covering is then impregnated with an asphaltic compound and finally given a coating of "finishing wax."

All of the wire-cable used in the car is made in this plant. The smaller sizes, for example, require no less than 146 braiding machines to cover rubber-coated wire with the different colored braid used to distinguish the various ignition wire cables. There are also 63 butt braiders which bundle a number of individual differently-colored cables into looms or assemblies. Everything needed in the cotton-covering line is made right at the plant. Even the short pieces of cotton-sleeving used to protect wires at sharp bends in the final assemblies are woven and at once cut to proper length after leaving the machines.

To make the threads strong enough for insulation purposes, twenty strands are twisted into one on this winding machine; the rack holding the spools is of Ford design.

A goodly part of the cotton covered wire is enamelled before this operation.

Enamelling

The enamelling equipment is probably unique. It is a battery of fifty machines made according to the design developed by Ford engineers. These machines provide four coats of enamel to No. 36 wire, the drying being done by means of electrical heating units. The machines somewhat resemble the enamelling outfits described in June WIRE & WIRE PRODUCTS by the American Insulating Co., but differ in essential details. One of the interesting points is the method adopted to prevent spongy and porous enamel coatings.

In a vertical electrically heated compartment, the greatest heat is concentrated at the center, and there was a decided updraft through the machine. Older designs called for a passing of the wire from one side of the machine to the other, the wire entering, say, at the right, passing to the top of the machine, thence down through the enamel for the second coat, again upwards, this time nearer the center, and so on. This caused the second and third coats to get a much more severe drying or baking, while the first coat was not quite dry. The result was blistering and production of porous coatings.

In the present machines the first two coats of enamel are applied and the wire passed through the hottest part (center) of the heating chambers, resulting in a thoroughly baked enamel. The third and fourth, or in any case, the last few coats are baked in the outer portions of the heating chambers so that even if not entirely dry, no blisters will form.

After the wire is enamelled and reeled up, the reels are al-

lowed to age for several weeks before the wire is used for the construction of any electrical equipment.

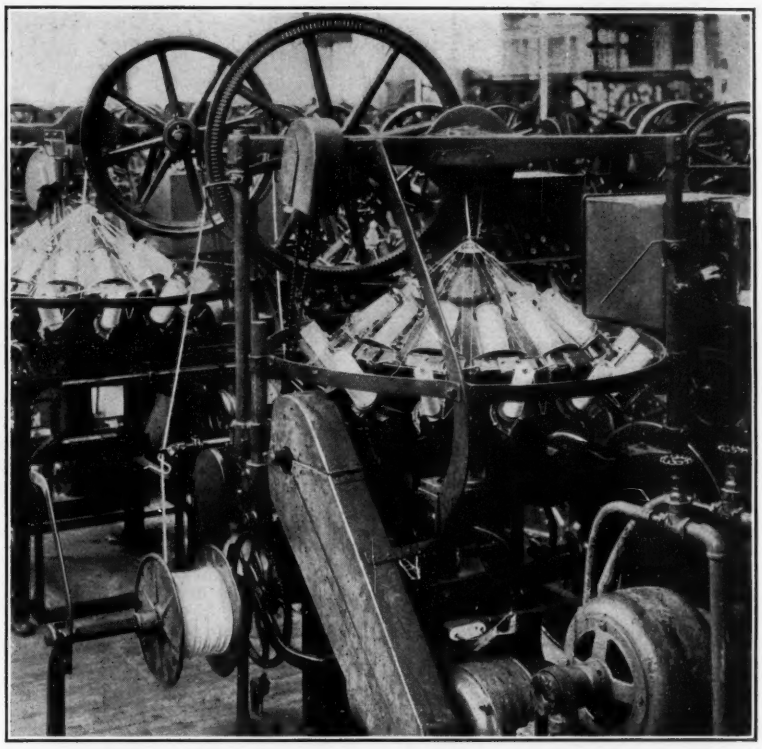
In addition to the fifty special machines described, there are also fourteen of the larger size of American Insulating Machinery enamellers in use. These provide five coats of enamel on larger size wire, say from No. 14 to No. 20.

The Ford Motor Co., has found electricity far superior to gas for heating their enamelling ovens. This is due to its greater cleanliness, lower fire-hazard and also to the cheapness of the current, which in this case is supplied by the huge powerhouse both at Highland Park and at the Fordson Plant.

All of the cable and wire assemblies, or harnesses as they are sometimes called, are made in the same department with the wire; thus eliminating costly transportation charges. This includes the wire leads for the low-tension distributer system of the ignition, the high-tension spark-plug wire; the heavy cable used to connect the battery with the starting motor, and the lighting and generator wires.

All of the transformers used on the car, as well as the magneto, starter and generator coils, are made in the plant. There are thirty four machines for winding the secondaries for the transformers (usually known to the Ford owner as the "coils" in the coil-box). Enamelled wire, with glassine paper between layers, is used. Each operator can produce upward of 500 complete secondary coils per day.

An interesting side-light on the over-all efficiency of the Ford plant is thrown by the fact that the man in active charge of this huge department was not a wire-man before he started on this job, but picked up the information as he went along. Hardly any of the employees were trained wire-makers, yet today the plant operates at top speed with great efficiency. A very noticeable thing about this plant—and this is true of the entire Ford factory—is the extreme care taken to keep everything as clean as a "whistle". There is no disorder and every machine is arranged with the minimum of wasted floor space and in strategic relation to the machine that does the next operation.



Six such machines are employed in the Ford plant to cover cable with cotton.

The plant is exceptionally well lighted by over head light in the daytime, and powerful electric light at night. Despite the large number of enamelling machines, the ventilation is so efficient that there is hardly a trace of an odor noticeable. Another feature is the excellent provision made to prevent accident. Every machine that is not individually motor driven (and most of them are) is lavishly provided with safety guards.

Diamond Dies

While the Ford Motor Co., has found it advisable to buy its chilled iron dies, it is finding it decidedly advantageous to manufacture its own diamond dies. This department is in the same location as the wire-drawing plant.

The diamonds, which are bought in the rough, are first provided with what is technically called "a flat", that is a flat surface. This is done by grinding against a wheel covered with diamond dust. The flatted stones are then placed in a mold and molten brass poured around them to form the basis for the die. The diamonds are then punctured by means of a plain steel needle, using diamond dust either in water or in olive oil to cut the stones. This operation takes from 28 to 600 hours, depending upon the size of the hole. The holes are then lapped to the proper size.

Special machines have been devised by the Ford engineers to do all of this work mechanically and with the minimum of human labor.

At present the production of dies is not large enough for all requirements, and quite a number are still being bought.

The total production of wire is already at such a point that wire for uses other than on the car is being made. Eventually it is the aim of the company to

(*Continued on page* 211)

Wire in the Delaware Bridge

Unique problems in the use of wire and how they were solved in the world's greatest wire structure

PART II

By Charles Carswell

Assistant Engineer, Del. River Bridge Commission

Strands of the cable in hexagonal form as constructed.

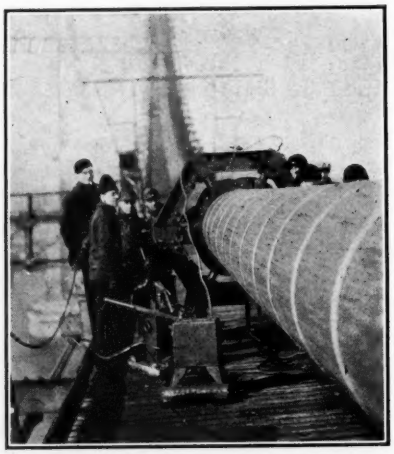
Hauling the Wires Across

IN placing the first wire across the river, reels of the rope for the support of the footbridges were mounted on a barge and as the barge was towed from Philadelphia to Camden, the ropes were laid on the bottom of the river. When twelve such ropes had been laid, river traffic was suspended for a few hours and the ropes hoisted out of the river and placed in temporary saddles at the tops of the towers. Previously constructed sections of planking for the footbridges were then hoisted to the tower tops and laid on the ropes, successive sections being slid down into place.

The haulage ropes by which the traveling sheaves were moved across the river were supported on steel gallows frames at the anchorage bents and towers and timber frames along the footwalks. The haulage rope was an endless rope for each cable, with the sheaves, or "spiders," so attached that one was in Philadelphia when the other reached Camden. Moving the rope shuttled the spiders back and forth across the river, each spider carrying a loop of wire as it moved. Each loop extended across the river meant two wires in place and as the sheaves moved simultaneously four wires were thus being put in place in each cable at the same time. When the sheaves arrived at the anchorage, the loop was removed and placed around a horse-shoe shaped casting used for anchorage of a strand of cable. A loop of wire for another strand was placed over the sheave and the return trip started, a similar operation having been performed in the meantime at the opposite anchorage. Men stationed along the footbridges took each wire as it was strung and adjusted it to have the same sag or tension as the guide wires or wires previously strung. The adjusting was done as rapidly as the wires were strung and without stopping the sheaves.

A strand of cable contains one continuous length of wire, looped around horse-shoe shaped castings at each anchorage and passed back and forth across the river 306 times. Four strands were formed simultaneously on each cable, in groups of two at each side of the footbridge. They were then bound with flat band seizings into circular form and lifted as units and put in place in the main cable saddles. The lifting of the strands into place was accomplished by hydraulic jacks moving in the steel frames at the tops of the anchorage bents and towers. At the same time, the strand shoe castings at the anchorages were turned through a right angle, from the position they occupied during building of the strand, to their final position between a pair of anchorage eyebars. The shoes are held in place by steel pins passing through the eyebars. After each strand was put in position, it was carefully adjusted to have the correct length and tension.

In order to secure the correct length of wires and sag in the completed cables, wires were carried across the river and accurately adjusted in the cable saddles to correct length before the first strands were started. These wires were then moved



Compacting the cable to a circular cross section.

to the temporary saddles at the side, used to build up the strands, and thereafter were used as guide wires for placing the first wires of each strand.

About five days were required for stringing the wires in each group of four strands, and from one to two days were required for seizing the strands, placing them in the saddles and adjusting them. Work was carried on for twelve hours each day. The greatest amount of

work accomplished in one day was the stringing of 578 wires, which represents an average rate for the traveling sheave of ten minutes from anchorage to anchorage. The entire work of stringing the 37,332 wires in the cables occupied twenty-four weeks.

Compacting.

Each cable contains sixty-one of the strands of 306 wires. As these strands were placed in the saddles they formed a section which was a regular hexagon. The saddles are machined in this form and timber braces were used along the footwalk to assist in keeping the strands in place. After all the strands were in position, the cables were compacted to force the wires into close contact and bring the cable to circular section. Compacting was accomplished by special machines consisting of six hydraulic jacks mounted in hexagonal steel girdles. The jacks squeezed the cables through bearing blocks, forming segments of a circle of thirty inches diameter. A total pressure of thirty tons was exerted by each jack, the pressure being applied simultaneously to all the cylinders. and the cable squeezed from the thirty-five inches diameter of the original hexagon to a diameter of thirty inches for the finished cable.

Because of the unprecented size of the cables of this bridge, a special test was made in advance of the cable construction to determine the diameter to which the cables could be compacted. A model section five feet in length was prepared of wires cut from the regular wires produced for the cables. Splices were made in sufficient wires to secure the same proportion of splices in the test length as occurs in the completed cables. Compacting of this model section reduced it to a diameter of 29⅛ inches. The first fifteen tons pressure reduced the cable from 35½ to 30½ inches diameter and an additional fifteen tons pressure was required to secure the final 9/16-inch reduction.

Placing a completed strand into the saddle at the achorage bent.

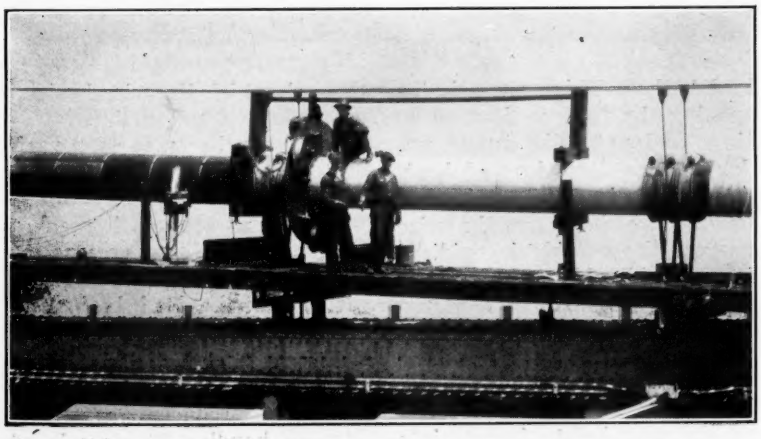
The steelwork of the bridge structure is hung from the cables by suspender ropes passing around steel castings bolted in place on the cables. These castings are semi-circular and have interior surfaces machined 16 cuts to the inch in order to increase the frictional resistance to slipping. The half sections are held together by heat treated high tensile steel bolts, each tightened to a tension of 60,000 pounds.

The Suspender Ropes.

The suspenders are of 2¼ -inch wire rope. Tests of the rope were made from every manufactured length, and acceptance was based not only upon satisfactory tests in direct tension but also upon satisfactory tests when bent around a sheave thirty-two inches in diameter. The latter test approximates closely the condition of the rope in the structure as it passes over the cable bands.

Each piece of suspender rope was measured to exact length while stretched around a sheave of the same diameter as the grooves in the cable bands, and was then cut and socketed for attachment of the structural steel. The sockets at the end of the rope are steel castings, with a conical hole through the axis tapering from two and one-half inches where the rope enters to five inches at the end of the socket. The end of the wire rope is passed into this socket and the strand wires are then opened out and cleaned thoroughly of the lubricant

(*Continued on page 210*)



Wrapping a section of the cable. The wrapping is of No. 9 wire, galvanized.

The Manufacture of Steel and Iron Wire in Germany

Types of furnaces and lead baths for the heat treatment of wire

By Dr. H. Altpeter

(Translated from Stahl & Eisen, by Carl Marx

THE main purpose of the heat-treatment is a fine grained structure in the finished wire. This is accomplished by either immersing the coils of wire in a lead bath at 430 to 500°C, or by slowly passing the wire, which of course has previously been heated, through such a lead bath.

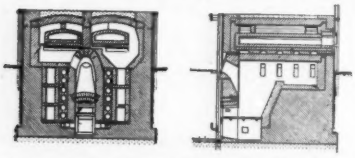


Fig. 1. German annealing furnace suitable for wire "cementation."

In the first instance the process is called "cementation", in the second case, "patenting". Both processes achieve the same ultimate result, differing only in the steps involved. Obviously cementation is the more rapid process and is usully employed for rather heavy wire, or such as is to be subsequently drawn down further, and in cases where the strength is rather more important than the uniformity. For high - class wire, such as is required for transmission wire-rope and for piano wires, the "patenting" process is to be preferred. For fine wire the cementation process is also not advantageous, as adhering lead, which when the wire is in the coil form is rather hard to shake off, will interefere with subsequent pickling and drawing operations.

In order to speed up production the patenting furnaces have been made much longer and the speed of passage of the wire increased. Figure 1 shows an annealing furnace suitable for wire cementation. It consists of a muffle, the interior of which is heated by means of gas to a temperature somewhat dependent upon the carbon content of the steel. The furnace illustrated takes 3 coils of wire and is run at a temperature of from 750 to 900°C. The process requires about 1½ hours, the two muffles shown being changed alternately.

In front of these muffle furnaces there are two lead-pans, which are bricked in below the level of the ground and are used for the annealing of the wire after its heating in the muffles. Usually these lead-pans are oval and dished, but occasionally they are rectangular. Wrought iron or cast steel is the material used for constructing the pans, although it is possible to make them from cast iron.

In the cementation processes, the wire is taken from the heating-muffle in individual coils, and rapidly immersed in the lead bath. This necessitates opening the furnace door every time, and naturally causes undue and needless loss of heat. A further disadvantage is that on opening the doors the wire nearest the outside is oxidized to a considerable extent. It is quite essential that the plunging of the hot wire into the molten lead bath be very rapid, as otherwise the annealing will not be uniform. Any oxide form on the wire before it gets into the lead bath will cause lead to adhere to the wire and interfere with other operations subsequently.

To make uniform wire it is advisable to keep the coils moving all the time that they are in the lead bath. The capacity of the ordinary lead-pans is from 0.3 to 0.5 cubic meters. The period of immersion is only a few minutes. In a cementation furnace as the one illustrated, from 2000 to 3000 kilograms (440 to 6600 lbs.) of wire can be treated in one shift, depending upon size of the wire.

The coal consumption depends very much upon the general efficiency of the installation, and may be from 10% to 40% of the weight of the wire. Only a small amount of heat is required to keep the lead bath up to temperature, as the immersion of the heated coils almost suffices for this purpose.

The patenting process is carried out in a long furnace through which the wire is slowly passed. The muffle of this furnace can be made of a variety of materials, such as chamotte stone, cast steel, or the like. The wire, as soon as it reaches the maximum temperature of from 800 to 900°C is at once immersed in the lead bath, and finally reeled up.

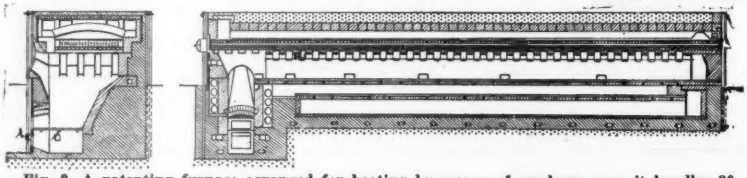


Fig. 2. A patenting furnace arranged for heating by means of producer gas; it handles 20 strands of wire at once.

Figure 2 shows a patenting furnace arranged for heating by means of producer gas. This furnace handles 20 strands of wire at once, and is built by the

German firm of Moehl & Co. The particular construction of this furnace has certain advantages. The gases are passed through the furnace so as to be used to the best possible advantage and to minimize the coal consumption. As contrasted to cementation-furnace practice, the escaping hot gases from the patenting furnace are not used for the heating of the lead bath, as the passing of the hot wire alone is ample to keep the lead heated. In the case of heavy wire it is sometimes necessary to practically put out the fire under the lead pans to keep the lead from overheating. With thin wire, on the other hand, the lead requires a certain amount of independent heating.

For thin wire, for example wire from 0.8 to 2.5 mm. diameter, the patenting furnaces are 6 meters long (about 20 feet). For heavier wire, as from 1.6 to 13 mm. the furnaces may be as long as 15 meters. Depending upon the size of the wire, the speed of operation and the method of heating, the coal consumption can be estimated as between 12 and 30% of the weight of the wire.

At the points where the wire enters and leaves the patenting-furnace, there are slots, usually closed with charcoal, to prevent the access of air to the space in which the wire is heated. It is also common practice to let the far end of the heating chambers, which are really long tubes, dip under the molten lead, a layer of charcoal helping to prevent oxidation and possible partial decarburization of the surface of the wire. The closeable slots in the machine also make it possible to observe the action on the wire, and to start new wire without letting the wire already in the furnace

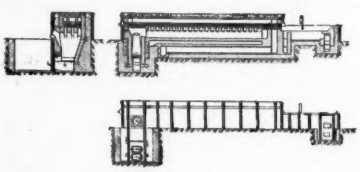


Fig 3. Annealing furnace ten meters long for the simultaneous treatment of 12 wires.

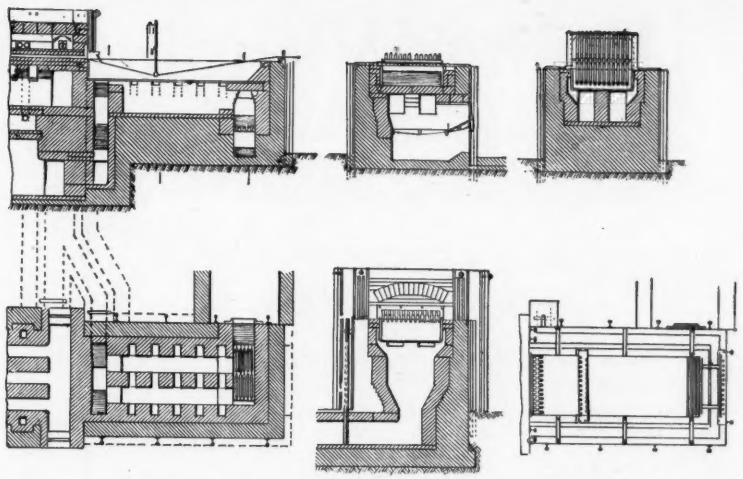


Fig. 4. Patenting furnace; showing the method used to immerse the wire into the lead bath.

oxidize.

For illustrations of these arrangements see figures 3 and 4.

Figure 4 shows the method used to immerse the wire into the lead bath. The apparatus consists of a cast-iron frame placed above lead-pans. According to the number of wires passing through the patenting-furnace, there are from twelve to twenty rectangular iron bars, capable of vertical reciprocating movement, and provided at their extremities with rollers which press upon the wire and push it beneath the lead. In some plants ordinary grooved pulleys effect the same result, the arrangement being somewhat similar to that used in hot galvanizing.

The size of the lead-pans depends upon the number of strands of wire treated at one time, but usually it holds from 0.8 to 1.5 cubic meters of molten lead. This is covered with charcoal powder to prevent oxidation.

The propulsion of the wire through the patenting furnace and lead baths is effected by an adjustable arrangement of discs and pulleys (see figs. 16 and 17), which allows of regulating the speed of the wire. Sufficient slippage is allowed to prevent the wire from attaining any speed, this being regulated by the pulling apparatus at the far end of the furnace. The wire as it emerges from the lead bath is run over discs against which it is pressed by means of rollers and counterweights. The revolution of these discs draws the wire at the given speed and it is only after leaving these drawing-discs that it is reeld up on the re-winds. This makes it possible to connect a new roll of wire at the end of one about finished without shutting down the furnace or slowing up the wire passing through, which, if it were done, would spoil whatever wire there was in the furnace at the time.

The speed with which the wire passes through the furnace depends entirely upon the ideas of different operators and varies widely according to the size of the wire and dimensions of the furnace. It is sometimes a fact that the speed of the drawing disc will vary from 2 to 20 r. p. m. for a furnace 8 meters long. The lower figure refers to wire from 6 mm. dia. downward, the higher for wire from 1 mm. upward. This carresponds to from 3.5 to 35 meters of wire per minute, based on a disc 500 millimeters in diamater.

The firm of Moehl & Co. suggests the following patenting speeds for their 9-meter furnace:

(*Continued on page* 212)

Doing Without the Jobber

A large spring manufacturer conducts a profitable business by selling direct to the retailer

By R. Schlossberg

MANUFACTURERS will look with disdain on attempts to eliminate the jobber by selling in small lots direct to the retail merchant. In many instances the reluctance to conduct such business is urged not merely by prejudice and convention, but by a sound estimate of costs. In most fields it does not pay to deal direct with the retailer.

On the other hand, not to recognize instances where the middleman may be eliminated with profit is patent folly. That such instances are numerous, the experiences of many manufacturers has proved. The retail cost of the merchandise is in such cases obviously decreased and not merely the retailer but the manufacturer himself reaps profits from this saving.

The W. B. Jones Spring Co., offers an interesting case in point. This firm manufactures a large variety of helical springs and carries on a large business exclusively by mail direct to hardware dealers.

The accompanying photograph shows an attractive cabinet designed to facilitate this maker-to-retailer business. This cabinet is sold by the W. B. Jones Spring Co. to the hardware dealers with a complete assortment of springs. The cabinet stands 20 inches high by 20 inches wide and 12 inches deep and contains 635 springs of 210 sizes. Each drawer is labeled for the type of spring and the compartments in the drawers are numbered for the size of spring contained. The cabinet of course contains only the most popular sizes.

The advantages of such arrangement are obvious. The cabinet makes it very convenient to handle stock and gives a ready index to sizes which need refilling. The advantages of this convenience accrue to the manufacturer for it makes ordering simple and prompt.

At present this company is doing business with 7,000 hardware dealers and doing entirely without jobbers. Its fill-in business is very large and indicates a judicious selection and arrangement of springs in the cabinet.

Chinese Market for Mild Steel and Wire Shorts

THE Chinese market for mild steel and wire shorts is one of large aggregate importations though the requirements of the individual are extremely small due to the fact that the large manufacturing enterprises are the exception rather than the rule. The demand for these particular materials, which is usually steady despite the fluctuations in other commodities, arises because the small articles made from these products are fabricated without the use of modern machine or hand tools and are dependent largely upon the skill of the individual workman. Wire shorts offered in this market range in gauges from 1 to 16 B.W.G. and should contain a fair proportion of all gauges, though gauges 10 to 16 are more popular and bring better prices.

(Report by Canadian Trade Commissioner L. M. Cosgrave.)

Overhead Monorail Systems in Wire Plants

By W. H. Eldridge
Service Engineer, The Louden Machinery Company

THE handling of wire in the plant offers an important problem in efficient management. While floor trucks are still used extensively, there is a manifest tendency in wire plants to replace truck and hand systems by some overhead conveyor.

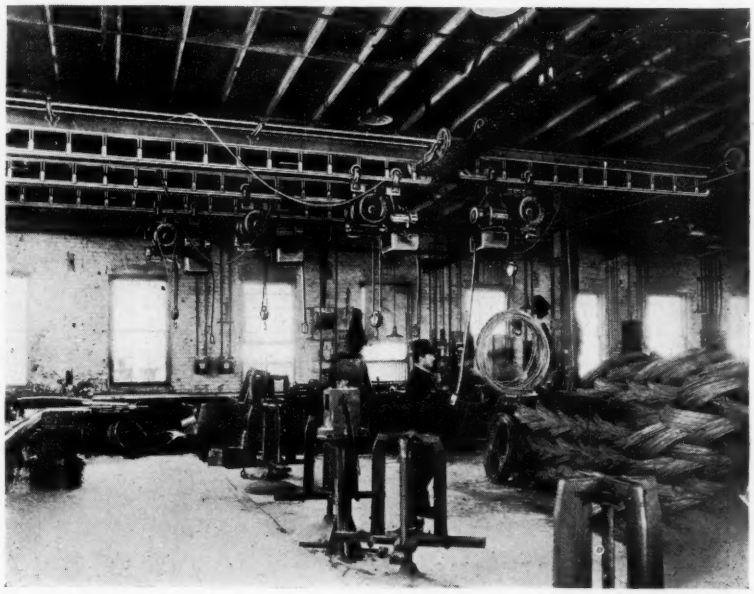
Overhead conveyor systems are in most cases, unquestionably superior to the floor trucks. Often such overhead cranes achieve effective reduction in handling operations and a consequent decrease in cost of production.

It will be of interest to review a few characteristic installations of such overhead monorail systems.

The Chicago Insulated Wire & Manufacturing Co., of Sycamore, Ill., uses an overhead monorail system, consisting of the following equipment: A light 12′ span Push & Pull Traveling Crane, equipped with a ¼-ton electric hoist, which operates over a long wire drawing bench, and on the crane runway, there are three operators, one crane to each operator. The coils of wire are handled back and forth from the stripper block to the hoist, and vice a versa until the wire is drawn down to the exact size wanted.

The accompanying photograph shows the installation in the wire drawing department using three 18′ span 1,000 lb. Push & Pull traveling cranes over the wire drawing table and one 12′ span 1,000 lb. capacity Push & Pull crane directly over the stock pile of annealed copper wire.

Each operator, of which there are three, on the wire drawing table, has a crane at his disposal, and each crane is equipped with ¼-ton electric hoist, with a hoisting speed of 40 ft. per minute. The crane is equipped with large diameter wheels, and all the operator has to do is to push the load for which, with the improved trolleys, little effort is required.



An installation of an overhead conveyor system in the wire department of The Chicago Insulated Wire Co.

On another installation not shown in the photograph, which is located in the next bay to the right, is another wire drawing machine with a traveling crane and electric hoist.

There is another interesting job at the Chicago Insulated Wire & Manufacturing Company's plant. Directly over the machine where wire is waterproofed with weather-proof compound, they have a large cooker elevated approximately 12′ from the floor. Running over two cookers a distance of one hundred and fifty feet is a one-ton electric hoist and trolley, which raises up the barrels of pitch and resin. These are dumped into the cooker and when properly melted, the compound is pumped down into the machine where the weather-proofing takes place. The hoist operates between two of these cookers of compounds, one of which is 18′ higher than the other. The cookers are charged twice daily and with this equipment only 30 to 40 minutes is required to a charge. This arrangement makes it possible for one hoist and trolley to take care of more than one compound cooker.

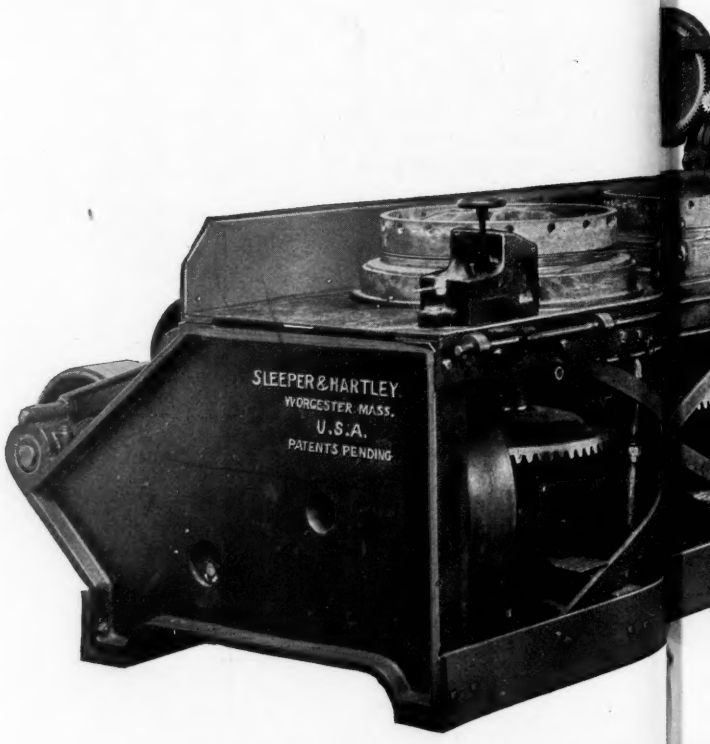
The Okanite Callender Cable Co., Paterson N. J., uses a monorail trolley with electric hoist built as a part of their winding machine for large cable. The reels of wire which make up the cable, weighing 1,000 lbs. are raised with a ½-ton electric hoist and placed in the right position in the machine.

Another installation of monorail is at the Standard Underground Cable Co. of Perth Amboy. On this job a mandrel weighing one ton is removed from the cable reel, which is on a turn table, and placed aside till required.

CONTINUOUS WIRE D

Sleeper & Hartley TRADE MARK

Patented in United States of America and the Principal Foreign Countries



CONTINUOUS ROD FRA-N

Built with 3, 4 chea

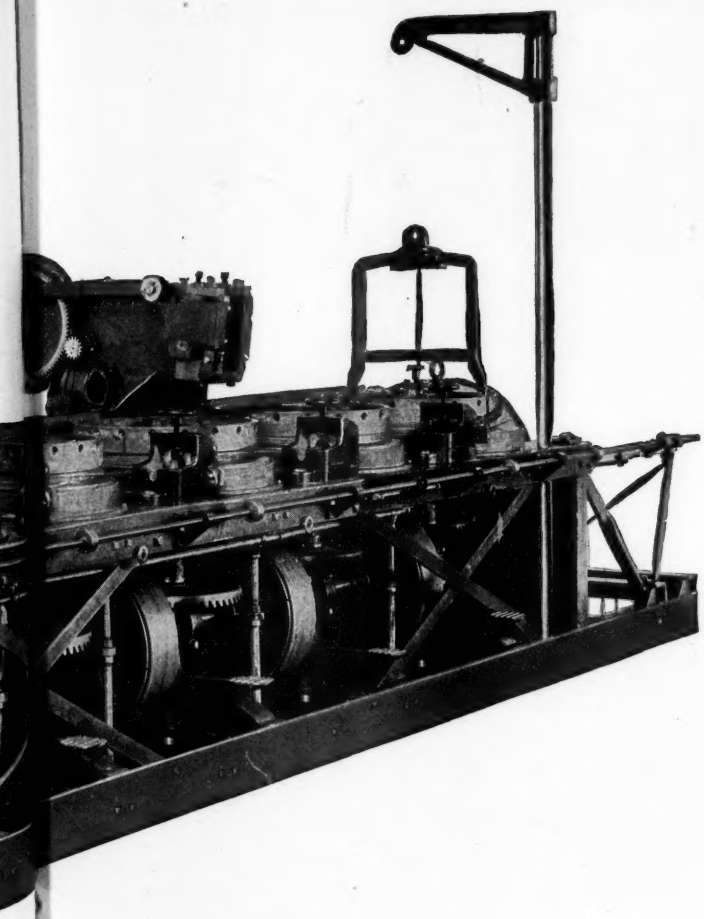
This machine is built without differential gearing of a in of drawing heads. These machines are put into prod on

AGENTS: CHICAGO TERRITORY, Neff, Kohlbusch & Bissell, Inc.

WORCESTER SLEEPER & A

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels.

RAWING MACHINERY



Sleeper & Hartley
TRADE MARK

An All-Ball-Bearing Machine

High Production

Low Maintenance Costs

Machine shown here is set up to draw No. 5 to 15

Runs off 4170 lbs. in 10 hours

RA–No. 5 to 14 or 15 WIRE
4 heads, as desired

f a kind. Automatic compensation for variations in speed
rodon immediately after making the motor connections.

& ARTLEY, Inc. MASS.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AND FINLAND—Akt., Rylander & Asplunds, Stockholm.

EDITORIAL · IMPRESSIONS

In Restraint of Trade?

IT is interesting to note the development of German and general European combinations for the control of markets in various industries. The German government has long looked favorably on such syndicates and cartels which are openly created to restrain competition at home and abroad. These cartels function in a number of ways almost invariably fixing prices and often manage a centralized sales system which makes contracts and distributes orders among member firms.

A larger but more loosely organized cartel extending over Germany, France, Belgium and Luxemburg and Austria is being planned now in the form of an International Raw Steel Syndicate. Under this organization the syndicate will control production according to the determined production and actual selling capacities of the various countries and at the same time will maintain free competition.

Such co-operative movements are very active in Europe and particularly in Germany, where under the pressure of the war indemnity, a marked intensification of production is taking place. German industries, according to recent reports, are freely exchanging technical information. Trade secrets are discouraged and competition is yielding to an unprecedented team work in the interests of Germany's industrial system at large.

In a recent issue of WIRE AND WIRE PRODUCTS we commented on a certain tendency to secretiveness still extant in some quarters of the wire industry. While the German industrial situation is extraordinary, the German way of solving extraordinary difficulties is worthy of careful study. Already, the method of co-operation in industry is showing very favorable results, and promises great success for the future.

Many of our American industries have learned their lesson from the intense co-operation necessary during the war, and since then have maintained their flourishing status without any trade secrets. Is the wire industry on an essentially different plane from others?

Wages—High and Low

MUCH discussion is afoot concerning Henry Ford's striking contention that higher wages lead to increased production; that the increase in production is so great that it enables him to materially decrease manufacturing costs, and therefore, the selling price.

One of our eminent contemporaries, the American Economist, takes its stand definitely on the side of Ford: "These (Ford's) statements, remarkable as they are, considering the economic trend of the times, are not theoretical, they are eminently practical — he (Ford) proves what he says in his own tremendous businesses that employ four or five hundred thousand persons, one way and the other.

"Wherever Henry Ford invades a new industry, like railroading and shipping, his first move is greatly to increase the wages of all his employees. Following that he usually shows diminished cost of operation with corresponding large increases in business."'

On the other hand, "The normal course," says another current periodical, "is for labor to earn higher wages and then get them. Mr. Ford raised wages first and then drove his men to earn them. While that may be done successfully by an individual management it is hardly to be recommended for trial as a national expedient."

Both these opposed views we believe express a partial truth. The relation between wages and production is cumulative. They react on each other to cause mutual increases. Which of them initiates this cumulative increase is a matter of particular conditions in an industry. The fact remains that Ford profitably increased the wages of employes in all his industrial enterprises, but less credulous observers might question: Was the resulting increase in production due to increased wages, or to increased efficiency in management?

Insurgents in Industry

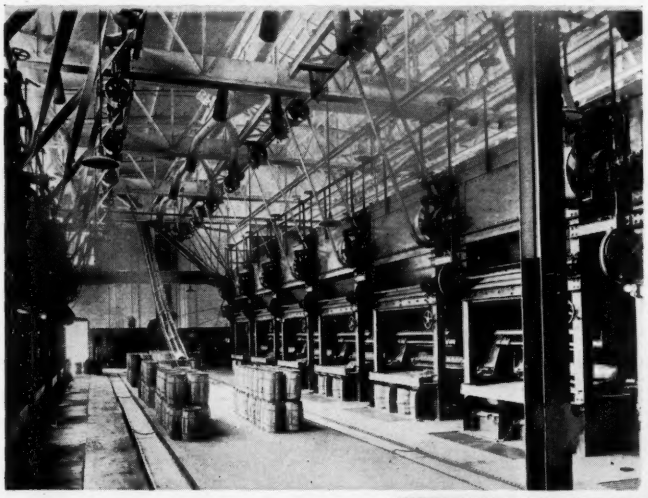
VARIETY—they say—is the spice of life. It is also the proper seasoning to industries, where, incarnate, it appears as invention.

An industry is an aggregate of technical processes adapted to a certain product and of commercial interests in the distribution of this product among consumers. We called attention in a previous editorial comment to a the necessity of developing new varieties of these products if the field of its distribution is to be extended. This larger economic function of the inventor—as the initiator of industril extension —has been much neglected.

An industry like that engaged in the manufacture of wire and wire products, has—so to speak —a certain mass and inertia, which tend to bring it into a state of equilibrium. To counter this tendency towards a settled, indolent condition the industry must be invaded and roused by new ideas. The insurgents who effect these salutary rebellions are the inventors,—a species of industrial fauna that deserve special cultivation at the hands of the manufacturer.

WIRE
& WIRE PRODUCTS

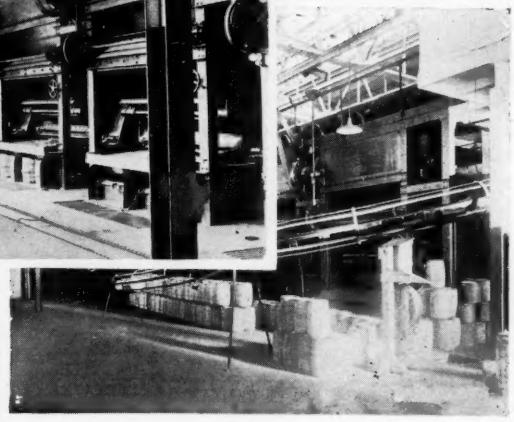
VIEWS OF THE WIRE WORLD

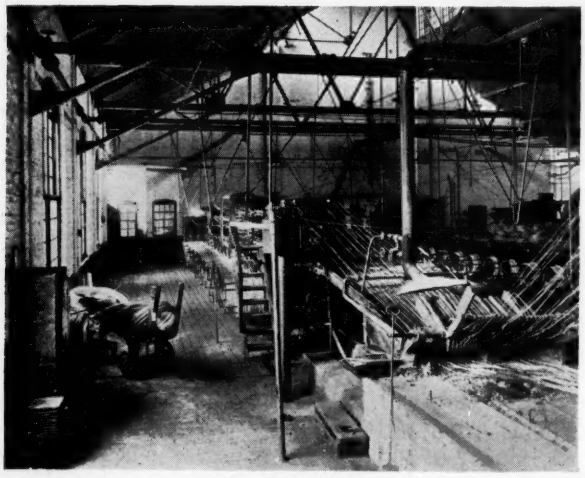


Nail cleaning and packing department. American Steel and Wire Co. The kegs are sent down on the chute from the department where they are made.

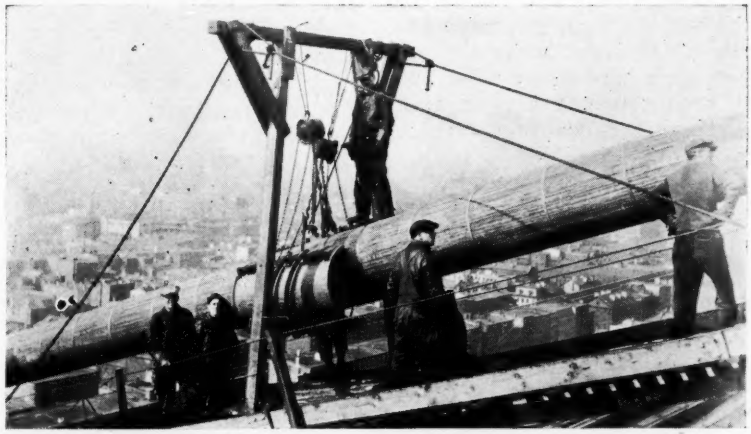
By Courtesy of U. S. Steel Corp

Below: Another view of the chote for the nail kegs, in the American Steel and Wire Co.'s plant.





At left: A view of the galvanizing department, in an American Steel and Wire Co. plant.



At right: Erecting a cable band on one of the main cables of the Delaware River Bridge.

If you have photographs of interest to the Wire industry, send them to Wire & Wire Products

Wire Rope Lubrication

Importance of proper lubrication for the maintenance of high efficiency in wire rope conveying systems

ENGINEERS who have made a careful study of conveying equipment know how important it is to have wire rope or cable properly lubricated when it is used where materials such as ore, coke, or coal are handled. The extent to which neglect of this factor may affect the efficiency of a conveying system, however, is not well understood. In many cases, those in charge of such equipment have very little information available on the proper methods of applying the lubricant or the kind of lubricant best suited for the purpose. The following abstract from an article appearing in a recent number of Lubrication, published by the Texas Co., New York City, gives some interesting information on this subject.

The ultimate efficiency of material-handling equipment is, to a large extent, dependent upon the condition of the cables or wire ropes. A rope with one or two broken strands due to rusting or wear, traceable to improper lubrication, may not only cause a tie-up of the entire machine, if such strands interfere with the operation of sheaves or other companion cables, but may also present a distinct hazard. Any wire rope in such condition is just that much weaker and less capable of handling the imposed loads.

Visualize how important this might be in the case of a car unloading device, for example, where loads approximating 100 tons are frequently handled. It is not enough to assume that because such ropes come from the manufacturers in a lubcricated state, being in general, wound on an oil-saturated core, that further lubrication is unnecessary.

The Occurrence of Friction.

There is constant friction and wear between the strands of wire rope while it is in use, and there is a tendency to squeeze out the lubricant, especially when the ropes pass over sheaves or around drums. The renewal of this lubricant is, therefore, an absolute necessity.

WIRE WEAVING LOOMS
By Max Irmischer
in the November issue of
WIRE & WIRE PRODUCTS

The matter of friction between the strands of a wire rope is essentially the same as friction between a bearing and shaft. Overheating and abnormal wear will practically always result in reducing the load-carrying capacity and increasing the amount of power consumed in operation. This can only be overcome by the proper application of a suitably prepared wire rope lubricant compound, which will not only be capable of penetrating to the innermost strands and core of the rope, but which will also be sufficiently adhesive and viscous to resist it being squeezed out or washed off by the rain.

Character of Wire Rope Lubricants

Essentially a wire rope lubricant, in addition to the properties mentioned, must not tend to cake, gum, or ball up, especially if contaminated with an excess of dust, dirt, or metallic particles. Furthermore, it must resist the thinning-down effects of higher temperature. This, of course, directly involves the viscosity or relative fluidity of the product. In fact, viscosity of such products is the essential characteristic involved in purchasing. It should not, however, be taken as the chief guide to the actual suitability of a wire rope lubricant.

In this regard, the ability of the latter to function, penetrate, and stick under actual operating conditions, is of outstanding importance. In consequence, such products should not be purchased haphazardly, nor on a price basis alone. The potential difficulties that might result are too serious.

According to the operating temperatures that may be involved, and the possibility of the presence of an excess of water, the viscosity of a wire rope lubricant should be 1000 seconds Saybolt at 210 degrees F., or somewhat lower. In warm climates, or when the ropes are adjacent to ovens, furnaces, etc., where there is danger of the lubricant becoming thinned down to such an extent that it will drip off, it is advisable to use a lubricant of about 1000 seconds viscosity at the temperature prevalent under operating conditions.

On the other hand, in relatively cold locations, such as are often found around lakes and in northern countries, it is advisable to use a somewhat thinner lubricant selected in accordance with the range of the operating temperatures involved.

Wire rope lubricants should, in general, be straight mineral petroleum products, devoid of fillers or thickening mediums. In other words, whatever the viscosity, it should be an inherent property of the lubricant,

not an artificial characterisic which cannot be depended upon.

It is for this reason that greases or soap-thickened mineral oils are relatively unsuited to wire rope lubrication. To attain the requisite body, a comparatively high percentage of soap would be necessary. Soap, of course, serves as the carrying meduim for the oil. It has relatively no lubricating value, therefore, this property in the resultant product is decreased to a marked extent. Furthermore, the adhesive characteristic of greases is low. In consequence, such products will not, in general, meet the requirements of wire rope lubrication.

Application of Wire Rope Lubricants

As a general rule, wire rope lubricants, by virture of their viscosity and inertness, must be applied in a heated condition. To merely attempt to daub or paint a rope with such a product at normal temperature would be impracticable. Even though the surface might be more or less coated, the possibility of penetration occurring to any extent would be remote. We must realize that this latter is the secret of effective wire rope lubrication. The amount of wear occurring between the exterior of such a rope and the sheaves is not so marked as that which occurs between adjacent strands when the rope is flexed or bent, as in passing over sheaves or hoisting drums.

The best method of treating wire ropes is, therefore, to use a form of split box for the lubricant which can be parted to permit it to be placed around the rope. The hole through which the rope passes is, of course, on the parting line. The lubricating box may be made from wood or metal. The shape of the box is determined somewhat by the angle or position of the rope. For horizontal ropes, a V-shaped box or trough with holes at each end near the bottom is generally used. Conical shaped boxes or containers are used for vertical ropes, the rope passing through

(*Continued on page* 212)

Detecting Broken Strands in Wire Rope

Felton & Guillaume introduce a method of identifying individual wires in wire rope

So much depends upon the safety of a wire rope and so serious are the consequences of a broken one to human life and property that such ropes are not infrequently replaced—on the "safety first" principle—by a new one before it is really necessary, whereas careful analysis might prove that it is still quite safe. But one cannot, by present-day means analyse such a rope without destroying it. Several methods have, from time to time, been suggested, by which it was proposed to examine ropes more or less **in situ**, principally by electric currents, but no satisfactory means have, so far, been adopted.

Messrs. Felten & Guilleaume, of Cologne, a firm of continental rope-makers of considerable repute, have introduced a method for which success may be prognosticated. It consists of certain arbitrary distinguishing features for every wire in a strand, and also similar features for each strand—the latter might be the twisting in of some coloured twine. With this facility it can always be ascertained how many wires are actually severed. The individual wires may vary slightly in diameter or the surfaces may differ, or their cross sections, may be polygonal, say, five, six, seven, or eight-sided. A similar idea is in use in telegraph cables which are covered with different coloured insulation. It is, however, only necessary that in one strand two wires side by side are distinguished, while in every other strand only one wire need be so marked, which is sufficient guide to identify every wire in every strand.

A wire rope consists of a great number of wires, and its total strength is represented by the sum total of the combined strength of all the wires. If a few wires break it is of very little consequence and these breaks are generally on the outer surface of the rope where the wire begins to become scoured from its contact with winding drums and guide sheaves. It might be considered, and with some degree of sound reasoning, that if the number of the broken wire ends are counted and compared with the original number of wires in the rope, it would be a guide towards determining the actual percentage of strength lost. Say, for instance, that the rope consists of 100 wires and six appear to be broken (from there being twelve loose ends), it would be wrong to assume that the rope has lost six per cent. of its original strength. This is, or may be, erroneous, because it is quite possible that one and the same wire is broken at a variety of points so that its multiple breakages would be discounted several times. This six per cent. loss is, therefore, the absolute maximum and the rope can probably be used with safety for some further period of time. Moreover, the wires in a finished rope are so closely united that a foot or so beyond fracture the wires are held so firmly in the strand that they only cease to bear their share of the load for an infinitesimal part of their length.

When the method, adversely criticised above, becomes reliable the result will be that a rope can be relied upon with safety up to the time when the factor of safety is no longer sufficient, instead of, as at present, being wastefully discarded before it has performed its legitimate duty.

"Fordertechnik."

Vianney Wire Die Works

(American Branch)

Etablissements
Joseph Vianney
Trevoux, France

Manufacturers of
DIAMOND DIES

New York Offices
100 Fifth Avenue
V. J. Boulin, Mgr.

Diamond Dies

Completely made in this Country by latest scientific method.

New way of
re-inforcing the Diamond
R. Kohl, Diamond Die Co.
655 Broad St., Newark, N. J.

The Patented Diamond Die

of proven superiority
through practice and not theory.
The standard of leading wire mills.
Manufactured by:
UNION WIRE DIE CORP.
250 W. 40th St., New York City

Digest of Literature

The Story of Steel by J. Bernard Walker, Harper Bros., New York, 1926. 208 pages. Four Dollars.

To those of us who remember the special edition of "The Scientific American," published in 1902, Mr. Walker's present book will need no introduction. The enormous expansion of the Steel Inustry an the dearth of readable books covering the field for the non-technical reader, fully justify the rewriting of the original articles, and the result is all that might be expected from such a source.

There is enough technical information to reward one in the business for his reading, and yet the language is plain enough for the veriest layman to read with interest and profit.

The various chapters trace in a logical manner the sequence of operations from the mining of the ore in the vast cuts of the Lake Superior district to the final marketing of the finished steel as rails, wire, rolled shapes, pipes, tubes, plates, and sheets.

The last four chapters, written in part by Edmund Brown, Jr., of the Brookmire Economic Service, form an authoritative discussion of the steel business from the standpoint of distribution, marketing, and financing, stressing particularly, as does the whole book, the policies of the United States Steel Corporation. Certain factors are set forth on returns to be expected on invested capital and stock issues, which will repay careful study and analysis, and invite comparisons with this very successful organization.

The Chapter on wire—of most interest to our readers—is on the whole clear and concisc, and would leave in the mind of one unfamiliar with our business a good general idea of the processes involved. Slight inaccuracies such as "crucible cast iron" for "crucible cast steel," and the inconsistencies of quoting tensile strengths first in English, and then in American units are, however, noticeable to a wire man, and would confuse the lay reader.

The typograhy and make-up of the book are good. The illustrations, however, did not reproduce well on the paper used, and, as, in a book of this character. "one picture is worth a thousand words," more illustrations and fewer inserts in them would materially enhance the value of the book to the general reader, and give the "man in the industry" a greater interest from seeing views of other plants.

"The Story of Steel" wil have a place on our shelves, and will doubtless often be consulted when we wish general information on allied lines of the steel industry. L. D. G.

Wire Cloth, Report A. S. T. M. committee D-14, Amer. Soc. T. M. Pro. 25 pt. 1:384.90 '25.

Description of long time exposure tests of representative wire screens of non-ferrous materials. The purpose of these tests is to determine the relative life of the higher grade screen wire cloths when exposed to various atmospheric agencies in different localities, so that purchasers of these materials may make an economic selection best suited to their particular conditions.

Galvanized Wire and Fencing. Amer. Soc. T. M. Pro. 25 pt 1:108-15, '25.

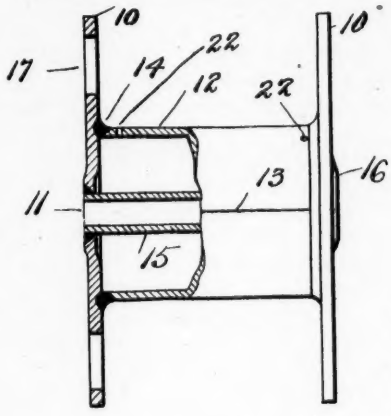
Recommendations of the committee on Metallic Coated Products, concerning the testing of galvanized products; among them wire and wire fencing. The zinc coating is tested both for quantity and uniformity.

Review of Patents

Conducted by
EUGENE GRUNSTEIN

Steel Reel.

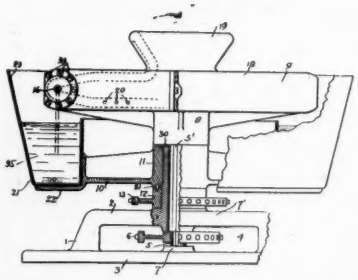
The object of this invention



is to provide annealing or stranding reels having the body and head plates welded together.

U. S. Patent No. 1,589,414, issued to Frank Mossberg, Attleboro, Mass. Assignor to Mossberg Pressed Steel Corp., June 22, 1926.

Extrusion Wire-Spining Machine.



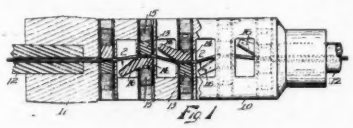
In this machine molten metal is extruded through dies by centrifugal pressure. The threads of metal are then slowly cooled by fluid means in a chamber which receives the extruded metal. The extrusion dies are constructed of tungsten or of some silica compound as fused quartz. The machine is provided with a number of spinning outlets whereby a series of wires may be produced independently and simultaneously, so that strands may be separately wound on spools or united into a twisted multi-strand cable.

U. S. Patent No. 1,592,140 issued to Charles Horton, Ridgefield Park, N. J., July 13, 1926.

Wire Straightener.

The invention, assigned to Sleeper & Hartley, Inc., relates to a wire straightening machine of the type in which the wire passes through a series of alternately off-set dies in a rotary arbor.

The principal object of this invention is to locate the guid-

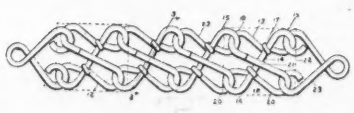


ing devices in such manner as to obviate additional adjustments. They are always to move with the dies and therefore will remain in proper position for performing their function.

U. S. Patent No. 1,594,570, issued to Frank H. Sleeper, Worcester, Mass, Aug. 3, 1926.

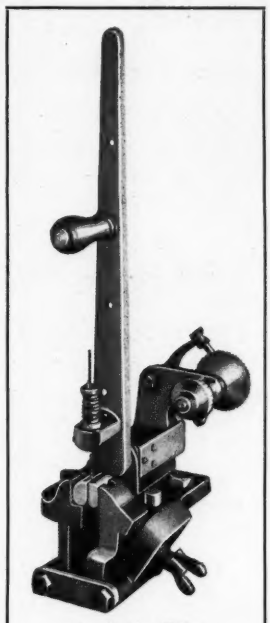
Novel Tire Chain.

A chain of unusual construction with its links so designed as to engage the surfaces of the road and of the tire at an oblique angle to the direction of



movement of the vehicle.

U. S. Patent No. 1,596,299 issued to Albert Olson, Jamestown, N. Y., Aug. 17, 1926.



Amsler's Wire Ductility Tester

The "Usefulness" of Wire in the Manufacture of Wire Products depends in Most Cases upon its "Ductility"

The best apparatus for investigating the ductility of round and flat wire, ferrous and non-ferrous, is the "Amsler Reversed Bending Tester" illustrated above.

This apparatus gives very valuable information. It can be operated by any intelligent man in the shop and it is inexpensive.

Every wire forming shop should be equipped with this handy, practical wire tester. Some plants are using a number of them in different departments.

Write for Full Description

HERMAN A. HOLZ

Testing Engineer
17-B Madison Ave. New York

Complete Line of High Quality Metal Testing Machines.

NEWS OF THE INDUSTRY

THE Harrison Bolt & Nut Co., Second Street, Harrison, N. J., is said to be arranging an early call for bids for a two-story addition, 100x100 ft., to cost about $45,000. Joseph W. Baker, 111 North Fourth Street, is architect.

THE Jeschke Wire Specialty Works, Crawfordsville, Ind., has been purchased by Woodard G. Jeschke, who for the past five years has been manager of the Campbell Wire Speciality Works at South Bend, Ind. The Jeschke works are moving into a larger and more modern plant at Crawfordsville.

THE U. T. Hungerford Brass & Copper Co., Lafayette, White and Franklin Streets, New York, has removed its Philadelphia warehouse to 46 North Sixth Street, corner Filbert Street, that city, where with increased stock and larger facilities, it will better be able to serve the Philadelphia district.

THEODORE H. WICKWIRE died Aug. 29, in a Buffalo hospital. He was chairman of the board of directors, Wickwire-Spencer Steel Corporation, Buffalo. He was born in 1851 and having conducted a hardware business in his younger days he entered in the manufacture of wire cloth in 1875. In 1907 he organized the Wickwire Steel Co. and was its first president. After the merger with the Clinton-Wright Wire Co. in 1920 to form the Wickwire-Spencer Steel Corp., Mr. Wickwire became chairman of the board.

THE Canada Wire & Iron Goods Co., 180 King William Street, Hamilton, Ont., will build an addition to its plant to cost $7,000. G. J. White, 165 Main Street, has the general contract.

CONTRACTS have been awarded in connection with a $30,000 addition to the plant of the Johnson Wire Works, 50 Dagenais Street, Montreal, the structural steel to be supplied by the Dominion Bridge Co., Ltd., 285 Beaver Hall Hill.

The Steel Treaters Convention, Chicago

BELLIS HEAT TREATING CO., Branford, Conn. Booth 35. Annealing lavite, carbon lavite and tempering lavite. A. E. Bellis, president; J. W. Black, sales engineer; J. J. Lynch, Industrial Engineering & Equipment Co.; M. K. Epstein, St. Louis, both Western sales representatives.

JONES & LAUGHLIN Steel Corporation, Pittsburgh, Booth 63. Jalcase steel, hot and cold finished, parts manufactured therefrom and other cold finished steels. Jalcase steel shown for the first time. W. B. Todd, manager of sales cold finished department; J. D. Allen, R. W. Light and G. C. King, all of the cold finished department; R. J. Stayman, manager Chicago office; M. A. Blessing, assistant Chicago office, and A. A. Wagner, assistant manager hot rolled sales department.

THE MASTER DIE

Assures Longer Life "on Size"

SAVES POWER AND
INCREASES PRODUCTION

FOR FULL PARTICULARS WRITE TO

MASTER WIRE DIE CORPORATION

408 Concord Avenue New York, N. Y.

SURFACE COMBUSTION CO., New York. Booth 162. Motion pictures, photographs, designs, control records of furnace installations. F. W. Manker, vice-president; A. L. Hollinger, Chicago manager; H. M. Heyn, Detroit manager; F. J. Winder, Pittsburgh; George Ruby and G. M. Anderson, Chicago.

DRIVER-HARRIS CO., Harrison, N. J., Booth 20. Nichrome high temperature resistance alloy for all heat treating applications. Nichromie Grade B for the improvement of cast iron shown for the first time. Harry D. McKinney, general sales manager; George A. Lennox, assistant general sales manager; J. C. Bilek, Chicago; W. E. Blythe, Detroit; H. D. Tietz, Chicago.

THE Johnson Wire Works, Dagenais Street, Montreal, Que., has taken out a permit for a $25,000 addition to its plant.

WILLIAM BROWN GLADDING, vice-president and a director of the United Wire Supply Co., New York, for many years a resident of Providence, R. I., died Aug. 31, at the home of his son-in-law, Charles Casey, at Sorrento, Me. He was 71 years of age.

The Development of Chain-making in Europe

(*Continued from page 189*)

This is of special advantage in cases where short lengths of chains are wanted of exactly the same number of links.

One operator working together with a helper is able to take care of five of these machines as their tools are located very accessibly and as they can be easily and quickly replaced. The machines are absolutely reliable in operation and have almost no vibration. Fifty links per minute can be easily obtained from one machine if 7/32 inch wire is used.

Their task is to perform the

(14)

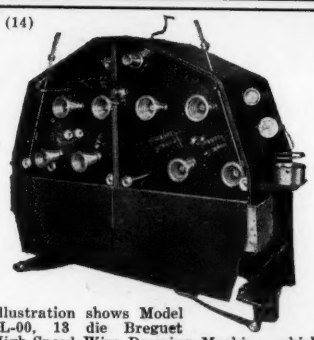
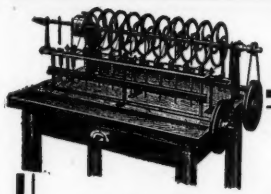


Illustration shows Model 2L-00, 13 die Breguet High-Speed Wire Drawing Machine, which draws No. 36 Brown and Sharpe Gauge and finer sizes of copper wire at a finishing speed of 4000 to 4500 feet per minute.

EST. 1855 AIMco INC. 1918
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
517 Huntington St.
PHILADELPHIA PENNSYLVANIA U.S.A.
EXCLUSIVE AGENT FOR
the United States, Canada, Mexico, Central and South America of the
BREGUET
HIGH-SPEED
WIRE DRAWING MACHINES
Patents Applied For in the United States. Patented in France and Great Britain.
SEND FOR CATALOG

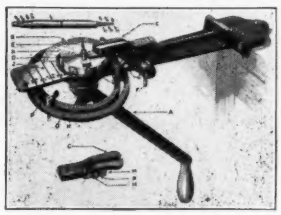
Wire Drawing Soaps and Compounds
STEELSKIN BRAND
(Registered)
For High or Low Carbon Wire
Working Samples sent on request.
Established 21 years.
R. H. MILLER CO., INC. HOMER, N. Y.



"POHENKRA" WIRE DIE POLISHING MACHINE
Indispensable For All Kinds of Wire-drawing
U. S. Patents
983929—1911
1039186—1912
England 16171
1910
France 420503
Germany 226062
Austria 46339
Gives an absolute guarantee of grinding the diamond holes perfectly round, a result hard to accomplish with all devices employed before.
Simultaneously grinds the entire wall of the draw stone, including the inlet and outlet.
Ten times more effective than previous devices; one workman unassisted can polish 30 diamonds simultanously.
Write For Descriptive Literature
F. KRAUSE & CO., Inc., 250 Ogden Ave., Jersey City, N. J.

KILMER LITTLE GIANT WIRE FORMER

Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.
Adjustable for No. 3 to No. 24 Gage Wire.
The cut on the left shows a few of the thousands of the forms made on this
FORMER
Price $35.00



Patented April 2, 1918
M. D. Kilmer & Co.
Cleveland, Ohio, U. S. A.
Box 237, Station B.

Continuous Wire Drawing Machine

A light, compact, and inexpensive machine of the ball bearing type, for rapid and economical production of fine wire.

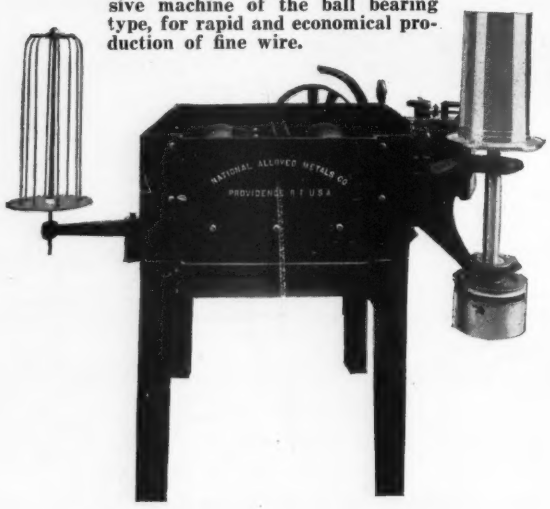


Illustration features No. 2 Machine. Capacity No. .20 B & S to .003.
We will furnish information on other sizes.

National Alloyed Metals Co.

69 Sprague St. Providence, R. I.

Continuous Wire Drawing Machines

Spooling attachments

Multiple head spoolers

Draw frames and rolling mills

Any and all modern equipment for the wire mill.

CYRUS CURRIER & SONS

NEWARK, N. J.
365 Market St.

first phase of the modern chain manufacturing process and to prepare the material mechanically for the second phase, the welding process.

In the electric welding machines used in this process the welding current must be in any case alternating, single phase or multiphase. If single phase alternating current is available, the machines are placed in circuit just as electrical lamps. In case where three phase is used the machines may be placed in one or two phoses of it. The main part of these welding machines is the welding transformer which transforms the line current to heavy heating current of low voltage; other important parts are the gripping and the pressing tools by which the ends joined during welding. All operations are performed by the same cam shaft which is driven by a tight and loose pulley and provided with an automatic clutch. The chain is brought to the electrodes by a special feeding device guide. The electrodes are automatically pressed by a spring upon the link-shaft near the joint where it is to be welded, the cam shaft is stopped by releasing the clutch and the current is switched on. The welding heat is generated within the material and radiates outward, and is restricted to the parts where the welding is to be applied. All loss and waste is eliminated by this process, and no air bubbles left in the weld.

At the same time, the grippers of the mechanism are brought together to an exact predetermined extent, to obtain the measurement called for in calibrated chains. Simultaneously, a swedging device reduces the swelling caused by the weld to two fins which may afterwards be trimmed either in a special attachment to the same machine or on a separate machine.

Utmost care has been spent on the pressing adjustment which may be made to a fine degree. It starts the movement of the cam shaft anew, stops the

current and moves the next vertical link into welding position. Every first, third, fifth, etc., link is welded and in the repetition of this process in the same machine or in a second welding machine, the second, fourth, sixth, etc., links are welded.

It is especially interesting to remark that the welded parts show very high quality, strength and uniformity, mainly for the reason that the intensity of the current as well as the timing of the operation may be regulated with greater accuracy.

This is proved by many trials showing that the welded links never broke at the welded points.

The transformers are of higher capacity than necessary so that any injurious heating caused by long use is avoided.

The Electrical Hand operated and Semi-Automatic welding machines, which are used mainly for non-calibrated chains and which make possible the welding to the chain parts of different shapes are also much used.

As the hand welding machines are constructed according to the simplest possible principles, their handling needs no special training or care. By guide tools the chain is gripped and the link which is to be welded is placed between the concave electrods. The pressing will be performed by moving a lever after the current has been switched on. The swedging press is operated where it is necessary by a pedal. The left hand of the operator is free to feed the chain. The electrodes, placed in water-cooled holders and are renewable. When the operation is applied to end welded chains, the chains will be moved from the front to the back of the machine.

The Fig. 9 shows the arrangement described in this article. (A) is the automatic chain forming machine, (B) an automatic electric chain welding machine, welding each first,

CHAIN —Forming Machines for the manufacture of electric welded-, unwelded- and knotted-Chains.

CHAIN —Welding Machines for electric welding; automatic-, semi automatic- and hand-operated.

High Production; Solid Construction; Reliable Operation; Handy Accessibility to the Tools.

ARE THE ADVANTAGES OF OUR MACHINES

MACHINES FOR
Bolts and Rivets
Gem Clips
Pins and Needles
Point Grinding

M. A. IRMISCHER-48 E. 41st. St., New York

Wire Drawing
Wire Nails
Wire Staples
Wire Winding
Wire Weaving

The "Superior" Wire Drawing Machine

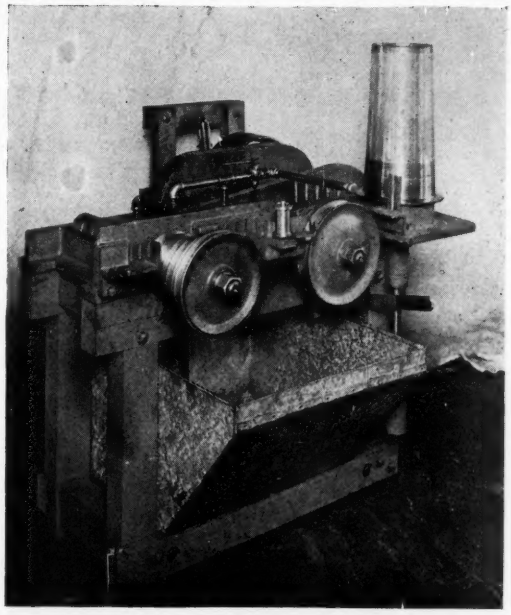
The ultimate in a compact and inexpensive machine.

One man efficiently operates 6 of these machines simultaneously.

6 Draft Wet type. Capacity .032" to .004".

Floor Space 39"x54"

Designed & Manufactured by



The Superior Tool & Mfg. Co.

172 Union St. Worcester, Mass.

American
Pressed Steel Reels
for strength, easy handling, service and long life

PRESSED steel is rapidly replacing other materials wherever both strength and lightness are desirable. This is the reason for the very general adoption of pressed steel reels and spools by large industries.

"American" Pressed Steel Reels and Spools are designed and shaped to impart maximum strength for their weight. They also embody special patented features that contribute to their rigidity and capacity for hard service.

Above is shown a 24" x 16" x 6" "American" Reel with beaded flange for shop use and shipping. Standard models range from small spools with 2½" diameter to giant reels 8' in diameter, and include Stranding, Vulcanizing, Impregnating, Braiding, Annealing, Shipping and Shop Reels and Spools and Beams for a great variety of industrial purposes.

Write for descriptive catalog explaining advantages of the "American" design and construction principles.

The American Pulley Company
Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes
4200 Wissahickon Ave., Philadelphia, Pa.

AMERICAN
PRESSED STEEL
REELS

third, fifth, etc., link with an attached trimming mechanism by which each welded link is trimmed. (C) is the second automatic chain welding machine with the same trimming arrangement, welding and trimming each second, fourth, sixth, etc. link.

From this can be seen how simple, clear and clean the manufacturing process has become.

The high efficiency of this process and the keen competition of today has induced many firms, especially in the last two years, to manufacture chains as thick as ⅝-inch by means of the electrical process.

Most probably it will need only a very short time that Form and Welding Machines are marketed on which material up to ¾-inch diameter may be used for the same manufacturing process. So far as it is known experiments already have been started.

Wire in the Delaware Bridge

(*Continued from page 193*)

used in the manufacture of the rope. Pure zinc poured into the socket fills the openings and secures a grip which develops the full strength of the rope.

The suspender ropes are attached to the vertical members of the stiffening trusses of the bridge. The trusses are of Warren type, 28 feet 2 inches deep center to center of chords. The chord members are nickel steel, the main web members are silicon steel and the intermediate members and minor details are medium carbon steel. The trusses were fitted together and splices drilled in the bridge shop yards before the steel was shipped and erection then proceeded as rapidly as suspenders were put in place. The floor system of the suspended structure consists of floor beams 8 feet deep with 18 inch I-beam stringers 3 ft. 10 in. apart. Erection of the steel proceeded simultaneously from each tower toward the center and toward the shore and was handled as a succession of movements of the erection travellers, only certain portions of the steel being erected at each movement in order to add the load uniformly and avoid excessive deflections.

The roadway slab is a concrete slab 6 inches thick on the suspended spans and 7 inches thick on the approaches, reinforced with shop fabricated steel trusses 4½ inches deep. Asphalt paving 2½ inches thick was laid on the suspended spans on top of the concrete slab. Granite block paving 3¾ inches thick, with asphalt filler, was laid on the approaches.

Wrapping the Cables.

For protection of the wire of which they are composed, the cables are encased with an armor of tightly wrapped wire, well painted. The wrapping is of No. 9 wire, 0.148 inch diameter, galvanized. It was applied by electrically operated machines which apply it under tension. Wrapping starts at the low points and progresses upward, thus bringing the wires into close contact. The wire is continuous between cable bands and at the bands is caulked into a space provided for it.

The total cost of the bridge is $36,000,000, including about $11,500,000 for real estate. Of the construction cost, $3,100,000 have been expended for the cables and suspender ropes. The cable contract was held by Keystone State Construction Company, Philadelphia, and the wire was made for them by American Cable Company at the Monessen, Pa., plant of Page Steel & Wire Company. Steel for the wire was furnished by Bethlehem Steel Company and the main towers were fabricated and erected by the Bethlehem company. American Bridge Company held the contracts for the anchorage steel and the main steelwork.

The bridge has been constructed as a joint enterprise of the state of New Jersey, the state of Pennsylvania and the

city of Philadelphia, acting through the Delaware River Bridge Joint Commisison. The work was designed and supervised by a Board of Engineers consisting of Ralph Modjeski as Chairman and Chief Engineer; George S. Webster, and Laurence A. Ball. Daniel E. Moran, Edward A. Byrne and Holton D. Robinson have been consulting engineers on the work. The preliminary report on design was presented June 9, 1921; physical construction was begun January 6, 1922, and the bridge was opened to traffic July 1, 1926.

The New Ford Wire Mill

(*Continued from page 191*)

provide all copper wire used in electric wiring, installation, for the Lincoln car as well as the tractors, and even for the railroad owned by Mr. Ford, the Detroit, Toledo & Ironton.

As an example of the infinite care taken, all of the insulated wire made at the Ford plant is hand inspected and all seconds discarded. This is in keeping with the general policies of the company to use nothing but the best of whatever is produced.

Visitors taken through the Ford plant pass through the middle of this wire plant, but those interested specifically in wire making would be accorded a pleasant welcome and shown around.

As Mr. Henry Ford has often stated, there are no secrets about the making of the Ford car, or any of its parts. Competition, as viewed by this unique organization, is based purely upon production—the ability to organize the complexities of machinery and human labor to such a point where the efficiency of the entire unit is such as to simply defy competition.

The writer is indebted to the kindness of the various superintendents who took considerable pains to show this plant in every detail, and to Mr. Henry Ford for permission to publish the same.

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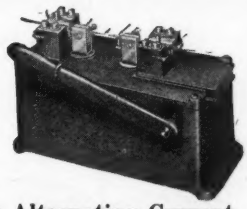

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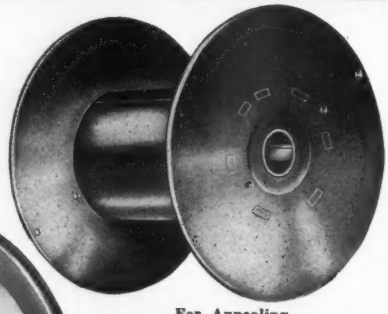

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140 S. Dearborn St., CHICAGO, ILL.
101 Augusta St., GREENVILLE, S. C.

Wire Rope Lubrication

(*Continued from page 203*)

a hole at the small end of the cone. Boxes of the kind can be readily built in the average plant, with suitable provision for rendering it sufficiently tight to prevent the lubricant from leaking out even when reduced in viscosity by heating. The slow passage of the ropes through such a bath of heated compound will not only insure thorough coating of the surface but also will cause the lubricant to penetrate to the innner strands. Further working of the rope over the sheaves before the lubricant has time to cool entirely will aid in bringing about maximum penetration.

Reprinted from Machinery, Feb. 1926.

The Manufacture of Iron and Steel Wire

(*Continued from page 195*)

5 mm. diamater — 2.5 to 3 meters per minute.
4 mm. diamater — 4.0 to 4.5 meters per minute.
3 mm. diamater — 5.5 to 6.5 meters per minute.
2 mm. diamater — 9.0 to 11.0 meters per minute.
1 mm. diamater — 15.0 to 17.0 meters per minute.
0 8 mm. diamater—17.0 to 19.0 meters per minute

The wire, after patenting, and before taking the same from the re-winding spools, must be allowed to cool gradually out of all draft, so that there will be no internal stressers set up in it.

As far as heavier sizes of wire are concerned, it may be stated that the cementation process will give results every bit as good as the patenting process, provided that the coils of wire are thoroughly and unformly heated and rapidly plunged into the lead bath and kept in constant motion while in it. Obviously, however, there will be noticeable differences in the bending and torsion tests between any two coils of wire, especially will there be marked differences between the

coils which have been near the doors of the cementation furnace and those further within. In the patenting process, on the contrary, a few tests will soon determine the proper temperature and speed and a few pyrometers properly placed will enable an accurate control of the operation.

As the large amounts of red hot wire which are plunged into the lead bath when carrying out the cementation process tend to suddenly raise the temperature of the bath and make accurate control difficult, attemps are usually made to overcome this difficulty by having the lead bath fairly large.

The proper temperature to which to heat the wire is readly determined by examining the wire as it is being treated in the dark, as then the heat-colors, such as bright red, cherry red, etc., are easily recognized. In order to obtain the best possible results, and with assurance that they will be uniform from day to day, it is essential that careful supervision be maintained. Electrical and optical pyrometers, and especially the photomicrographic examination of cross-section of the wire will be especially valuable.

Attempts have been made, specifically in England, to substitute air-cooling for the lead bath, and good results have been obtained, despite the fact that this causes the formation of quite a lot of scale on the wire. For heavy wire it has become quite popular, and the wire made this way is said to be very uniform and to show excellent qualities when examined by the bending and torsion tests. The best way to explain the action of air-cooling is to assume that as the surface of the wire cools, the heat in the interior acts as an annealing-agent, so that the martensitic structure at the surface of the wire, caused by the first chilling effect of the air is transformed into either Troostite or Sorbite.

Although air-cooling appears to be somewhat more economical as there is no expense for maintaining the lead bath, other expenses arise due to the necessity of removing the scale. To minimize the amount of acid required for this purpose, a good part of the scale is mechanically removed from the wire by passing the same through a number of rolls before re-winding.

Still another method used in place of the lead-bath, is the sand method, in which the wire passes through hot sand which is moved mechanically in a direction opposite to the one the wire is traveling. As the formation of scale is thus prevented, the process appears to have some utility and some parties claim to have obtained excellent results with it.

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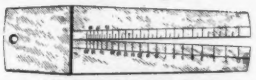

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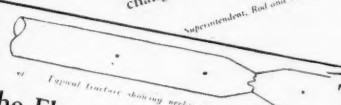

Typical fracture showing necking down and final puncture

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The Elongation of Wire and Its Measurement

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The Manufacture of Steel and Iron Wire in Germany

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Continuous Wire Drawing

PART II.

An authoritative discussion of controlled loop and modified slip machines

By Kenneth B. Lewis

Modern Methods of Handling Wire Rods

An overhead electric crane system covering the entire plant

By George R. Harrison

Review of Patents

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The New Ford Wire Plant

Unique installations and shop methods in the Wire Department of the Ford Plant

By Carl Marx

A few articles that have appeared in the last few issues of WIRE & WIRE PRODUCTS

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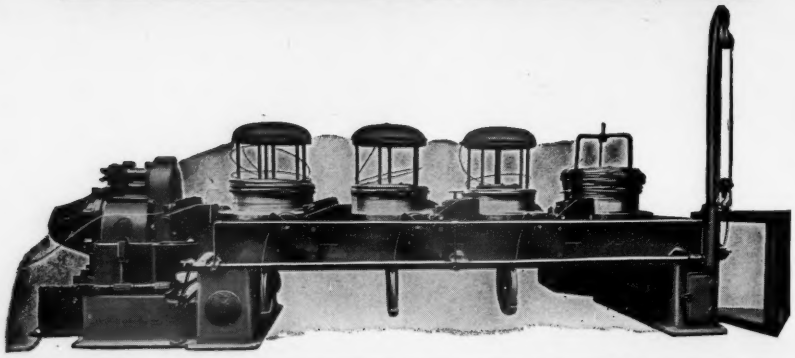
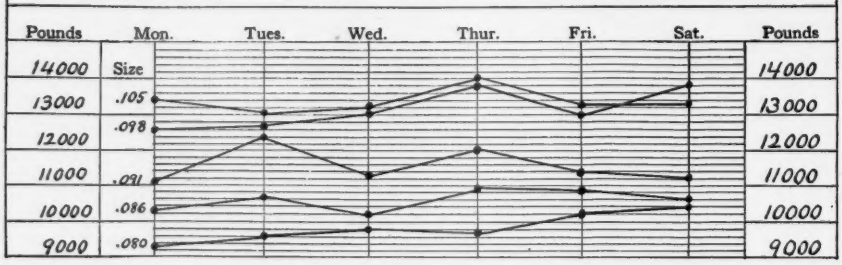


Production per man per shift (10 hours) from No. 5 Rod



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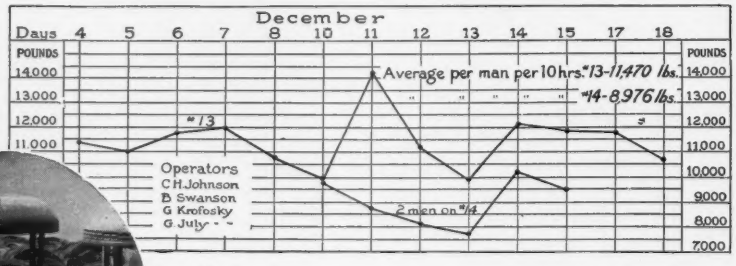
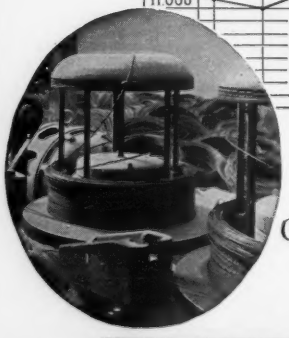
is the outstanding characteristic of the
Morgan-Connor Wire Machine





"The chart above gives in the form of a composite curve the average output per man per day of four operators running eight machines at the Portsmouth Ohio Plant of the Wheeling Steel Corporation.

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